

United States
Department of
Agriculture

Forest
Service

Forest
Pest
Management

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Subject: White fir mortality in the MOH Project Area, Hat Creek Ranger RD
(FPM Report # NE97-4).

To: District Ranger, Hat Creek RD, Lassen National Forest

The Lassen National Forest has experienced above normal levels of white fir mortality since the early 1990's. Most of the mortality has been in the east side and transition zones of the Forest at lower elevation, drier sites in response to the recent protracted drought period which began in 1987. Factors involved with the high levels of mortality have included overstocking, an increase in shade tolerant white fir, the fir engraver beetle and the extended below normal precipitation period. Over the past 2 years the level of white fir mortality on the Forest has decreased due to an increase in precipitation and reduced competition among the remaining live residual trees. Salvage removal is continuing in an effort to capture some of the commercial value and reduce fuel loading.

At the request of Mary Price, Culturist, Hat Creek RD, the MOH Project Area was reviewed by Sheri Smith, Entomologist and Robin Petersen, Biologist, on April 30, 1997. The objective of the field visit was to take a general look at the area in terms of mortality and discuss marking guidelines that may be appropriate to use in the thinning/salvage project. The MOH Project Area encompasses Blacks Mountain and the immediate surrounding area. Stand composition is primarily ponderosa pine and white fir. Current basal areas range from about 200 to 450 sq. ft./acre. The site index for individual stands ranges from 40-60 with most acres have a site index of 50.

Most of the mortality has involved white fir although some older pine mortality is apparent in the area. Based on the characteristics (needle retention and color, bark sloughing, etc.) of the majority of trees most mortality occurred prior to 1996. Although some top kill and scattered branch flagging was observed it appeared as though the result of the drought and fir engraver beetle attacks was primarily whole tree mortality. At the time of the field visit there was minimal new mortality observed. Fading of true firs that were attacked during 1996 would not be expected to occur until late spring or early summer of this year; however, based on continued decreasing levels of mortality in the area over the past two years and normal or above normal precipitation, I would not anticipate much additional mortality to be visible this year.

The MOH Project Area lies entirely in the eastside vegetation zone for the Forest. Forests in this drier eastside climate are typically dominated by ponderosa and/or Jeffrey pine. North and east facing slopes retain more soil moisture and also support mixed stands of yellow pine and white fir. Average annual precipitation in this project area is between 20-25 inches annually (Source: Rantz, S.E. 1969. Mean Annual Precipitation in the California

Region. U.S.G.S. Menlo Park, CA). The highest elevation is Blacks Mountain at 7,286 ft.

Individual conifer species can grow under a range of precipitation regimes. Land managers should be cognizant of these precipitation regimes when developing land management objectives based on existing vegetation. Objectives may not be attainable if species have established in the wetter or drier extremes of their range since these sites will not likely be suitable for the duration of the tree's life; therefore, the species will not be sustainable.

Each species of vegetation has a competitive advantage along the soil moisture gradient. Various weather patterns, in combination with management practices (ie. fire suppression, harvesting practices) can enable different species to occupy various sites for many years or centuries. This is likely the case for several areas in the project area. Regardless of the mechanisms that were involved in the development of the current vegetation, the following conclusions can be made about the existing condition:

- 1) White fir is much more predominant than likely existed prior to European settlement.
- 2) White fir is present in areas which under normal conditions receive precipitation that is near the lower limit for the species.
- 3) Existing stocking levels are higher than some sites can maintain, particularly during through protracted dry periods

These conditions do not lend themselves well to being able to withstand the frequent occurrence of below normal precipitation periods experienced in California. When normal precipitation is not received species growing in these areas become drought stressed. This stress is exacerbated by overstocked growing conditions. Conifer species which are growing in areas that receive less than their optimal amount of precipitation, are more susceptible to insects, pathogens and weather disturbances. Pine species and white fir have increased in size and number over the past century; however, over the past 10 years precipitation has been extremely limited. The result of this has been unacceptable levels of white fir mortality in many areas.

California white fir grows in cold, high elevations and in warm to hot, low elevations (Silvics of North America, Vol. 1 Conifers, U.S.D.A. Agricultural Handbook 654). The best stands of white fir develop in areas receiving 40 - 50 inches per year. The lower limit of precipitation for sustaining white fir is 20 inches per year (Silvics of Forest Trees of the United States, U.S.F.S. Agriculture Handbook 271).

White fir existing in areas receiving 20 - 25 inches of annual precipitation (MOH Project Area) are at the lower limit of their range during normal precipitation periods. When conditions such as protracted drought or overstocking occur, white fir trees become predisposed to attacks by the fir engraver beetle. During relatively wet periods, similar to those experienced over the past 100 - 200 years, the more shade tolerant white fir has established, and in some cases, has lived long enough to achieve co-dominance

and dominance in crown position; however, the sustainability of the majority of these trees is not likely. Fire suppression and past harvesting practices are additional factors involved with the vegetation change over the past 100 years. These areas (20-25 in. annual precip.) should be viewed as being at extreme risk to high levels of white fir mortality during protracted drought periods. Management objectives should emphasize pine and other more drought tolerant species in these areas. Some white fir will survive long periods in this area as evidenced by several larger trees; however, management objectives should not attempt to maintain this species as a major stand component. If there is a desire to retain the residual large, live, white fir, it may be necessary to thin around these trees to reduce competition for available soil moisture

Depending upon management objectives, some silviculture treatments can enhance or help maintain the coniferous component in the area. Silvicultural treatments can make the stand's growing space available to desirable species and/or put individual trees in a competitively advantageous position. Thinning stands to a lower basal area while favoring those species that are best adapted to the sites should decrease the amount of future bark and engraver beetle-related mortality in the project area.

Salvaging dead trees has no effect on the bark and engraver beetle populations or future bark beetle-related mortality. Salvage logging would remove some of the wood while it still has commercial value and also reduce the amount of standing and down fuels. Since the mortality is decreasing within the project area I would recommend the use of a desired residual basal area achieved through a combination of salvage and thinning rather than attempting to predict individual white fir tree mortality based on external characteristics. If the residual stand is composed of the desired basal area represented by the healthiest, best-formed trees in the population with residual selection based on crown canopy, the absence of significant tree damage, and a preference toward drought tolerant species, the susceptibility to bark and engraver beetle attacks in the future will be reduced significantly. Many of the trees with top kill and/or scattered branch flagging (typical characteristics in salvage marking guidelines for true fir) would be removed because they would not meet the selection criteria above. In pockets where excessive mortality has occurred there may be openings greater in size than desired. Desired basal areas may not be attained in these openings without some type of reforestation efforts of desired species.

Examples of marking guidelines have been forwarded to the District. If you have any questions regarding this evaluation or request additional assistance please contact me at 916-257-2151.



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